Persephone MarkII

Analogue Duophonic Fingerboard Synthesizer

User's Manual

Eowave

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Congratulations! You're now the owner of a Persephone MarkII, a wonderful new instrument inspired by the first electronic non-keyboard instruments whilst featuring the most advanced sensor technology. We hope that you will enjoy playing this unique instrument and that it will bring a new dimension to your creativity. The Persephone MarkII is a handmade instrument and therefore, individual units can differ from one another. For any questions, please contact eowave at info@eowave.com

CAUTION!

Before using the Persephone MarkII, make sure you have read the following instructions carefully, as well as the instructions for use.

RISK OF ELECTRIC SHOCK, DO NOT OPEN OR MODIFY THE PERSEPHONE
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
TO REDUCE THE RISK OF ELECTRIC SHOCK,
DO NOT REMOVE COVER (OR BACK).
NON USER-SERVICEABLE PARTS INSIDE

Do not try to repair the Persephone, its ribbon, its expression key or its components inside. Please contact Eowave for technical support.
Avoid all sharp object contact on the ribbon.
Do not use the Persephone MarkII or store it under extreme temperature conditions or expose it to direct sunlight, damp or dusty areas, areas prone to strong vibrations.
Before you plug in the Persephone MarkII, always check the voltage.
Protect the Persephone MarkII against violent shocks.
Before using the Persephone MarkII in a foreign country, check if the voltage is compatible.
When the Persephone MarkII is not used, switch the unit off.
Never place heavy objects on the Persephone MarkII.
Never touch the Persephone MarkII with wet hands when it is plugged in.
Before moving the Persephone MarkII, make sure the unit is disconnected from other devices.
Before cleaning the Persephone MarkII, make sure the unit is switched off and not plugged in.
During lightning, unplug the Persephone MarkII.

Persephone: What is it? Where does it come from? A little bit of history…

This is an excerpt from the paper written by Emmanuelle Gallin/ Marc Sirguy: *Sensor Technology and The Remaking of Instruments from the Past,* published by NIME09 © 2009 Carnegie Mellon University.

Introduction

Are we the future of the past? Let's go back to the early twentieth century and the recent invention of filters and VCA, which has been followed by the invention of many new controls and new electronic instruments. If among these, many are now parts of our cabinets of curiosities, some are worth a closer examination… Sensor technology now enables to recreate some of these forgotten controls with a new accuracy, turning them into innovative tools.

1. HISTORICAL PARALLELISM

A quick historical comparison between the XXth and the XXIst century will lead to the conclusion that both centuries have known, in their early years, a certain effervescence in the design of new controllers. This parallelism can be explained by recent discoveries that have, at both times, opened wide fields of new technical possibilities. May it also find its origins in a particular political and economical environment – this won't be the subject of this paper.

1.1 1920s effervescence

The creation of the first electronic oscillators, followed by the invention of filters and VCA enabling to play tremolos and vibratos and to recreate the musicality of classical instruments, opened the field of the research for new controls, which would offer more possibilities than generic keyboards. The 1920s remains the most fertile years for the evolution of electronic music instruments with the invention of new controls like dial-operated non-keyboard electronic instruments or ribbon-controlled instruments. In Russia, Lev Sergeivitch Termen developed the Theremin using the body capacitance as a control mechanism, freeing the performer from the keyboard and fixed intonation. He also created the first fingerboard cellos. In France and in Germany, a whole family of dial-operated non keyboard electronic instruments was developed. Among them, René Bertrand and Edgard Varèse's Dynaphone or Jörg Mager's Electrophon and Spharaphon. At the end of the 1920s, a family of the fingerboard instruments –or ribbon controllers- appeared. In France, les Ondes Martenot, designed by Maurice Martenot, included both a seven-octave keyboard and a ribbon controller that allowed pitch inflections like a voice or stringed instrument. It allowed for a wide glissando when the player moved a finger ring attached to the metal ribbon that controlled frequency. Hundreds of symphonic works, operas, ballets, and film scores were composed for this instrument by Varèse, Honneger and Maessian.

In Leipzig, Peter Lertes and Bruno Helberger developed the Hellertion. This fingerboard was a flat metal resistance strip covered with leather. Depending on where the strip was pressed, a different resistance in the circuit was created altering the voltage sent to the oscillator and thereby producing different pitches. The force of the pressure controlled the volume of the output signal. The fingerboard was marked to help the performer find the correct pitch on the strip and had a range of approximately five octaves. The original instrument had just one fingerboard strip which was gradually increased to four and then on the later models, six aligned in parallel horizontally at the height of a piano keyboard. The four and six strip models allowed four and six voice polyphony.

The Trautonium was the first instrument to ally position and pressure control. Created in 1931 by Franz Trauntwein, it used filters to modify the timber of the note and a keyboard. The Original Trautonium had a fingerboard consisting of a resistance wire made of a tube of graphite stretched over a metal rail marked with a chromatic scale and coupled to a neon tube oscillator. When the performer was pressing the wire, it would touch the rail and complete the circuit. The Trautonium had a three octaves range that could be transposed by means of a switch. The Sonar, developed

by N. Anan'yev in the USSR in the 1930s also had a fingerboard continuous controller to vary the pitch of the oscillator.

1.2. The supremacy of keyboards

After the 40s, the general use of keyboards (and the war) slew down the research of new types of controls. Ribbon controllers were back in the 1960s with Moog ribbon controllers which Keith Emerson was famous for attaching to a pyrotechnics control. The Theremin-like sound in the Beach Boys' song "Good Vibrations," was played by a ribbon-controlled instrument called the Electro-Theremin, which the Beach Boys have later replaced by a Moog ribbon controller with a Moog synthesizer.
Only a few synthesizers from the 1980s had ribbon controls: Yamaha CS80's ribbon controller, Kurzweil synths and the Korg Prophecy.

2. THE XXIST CENTURY AND THE EMERGENCE OF NEW CONTROLS

The 2000s offered new possibilities with the development of sensor technology and new computer controls. Today, new controllers designed by the gaming and communication industries are much more innovative than the controls developed in the music industry. The general use of these new controls necessarily has a deep impact on the demand from musicians for new controllers as well as on the invention of a new approach for making music. Will brands like Apple or Nintendo be at the origin of a new musical gesture? Communication & game new controllers, such as Apple IPod, IPhones, ITouch, Nintendo Wiimotes, or DS with Korg D-10 for example, are commonly used by musicians as new tools for controlling music -first advantage being the low prices of these new tools. Though they offer a choice of innovative controllers, their low sampling resolution remains a barrier for making music (the number of values being insufficient for a musical gesture). On another hand, new controllers made for musicians are often limited to a closed non editable environment. Some artists and circuit bending specialists modify these new controllers to have a higher sampling resolution (12 bit allowing a resolution of 4096 values), but this approach is rare for a larger public. In general, the re-appropriation of control tools, which have not been thought for musicians and are not designed for musical applications, is limited in terms of use. Though it is possible to imagine that these new controllers could be at the origin of a new intuitive control gesture? The question of intuitivity in musical gesture must refer to an acquired gesture, but not necessarily to a musical gesture. The analysis of this intrusion of new control gesture into the music area is fundamental for all music industries and controller new designs. The « learning limit » is another important aspect for the design of new instruments. Among the forgotten controllers from the past, many have disappeared because their play required to be learnt. The past experiences with controllers tell us that a controller must be intuitive. The fact that most of the non-keyboard instruments using new controllers required a new play explains why they remained unpopular with musicians who had little time to practice on unusual keyboard, the Telharmonium 36-note-per-octave keyboard designed by Cahill for example.

3. REMAKING RIBBONS : THE PERSEPHONE EXPERIENCE[i]

In 2002, we decided to work on a contemporary version of a fingerboard instrument, using sensor controls today's technology would offer but preserving the best of analogue sound generators. Beyond a vintage look, the Persephone allies sensors technology and digital controls to a pure analogue generation of sound. Its analogue oscillator can generate notes with a range of 10 octaves, which goes from a deep and resonant cello tone to a nearly human voice[ii]. And on the highest pitches, it can reach very high frequencies. The oscillator waveform can be set between triangle and saw tooth for a more or less brilliant sound. Its ribbon sensor technology allows all kind of glissando a Theremin or Les Ondes Martenot would allow, though the sensor ribbon is much more precise than the tube full of graphite used as a variable resistance in the Trautonium.

The way the Persephone is played creates the instrument personality. The Persephone follows the traditional play of the first non-keyboard electronic instruments with the right hand controlling the pitch and the left hand controlling the velocity. Control gesture is very intuitive, expressive and accurate enough for playing scores – not only sci-fi effects.
Like on the Trautonium, the Persephone's ribbon is sensitive to pressure and position. The ribbon is a linear potentiometer that generates different control voltages depending

on where it is touched. These changes in voltage are applied to the voltage-controlled oscillator and the filter. A 12 bits converter samples analogue signal from the ribbon to send them in MIDI or control the oscillator. In the 5 octaves mode, the 12 bit sampling enables a resolution of 68 cents per half tones –the average human perception range being of 8 cents. This avoids scales effect and it is possible to switch from mode A to the other modes without hearing the analogue/digital switch. An expression key controls the filter. This kind of key was also found on Les Ondes Martenot. With the Persephone, it is controlled by an optical sensor able to reproduce vibratos.

Four play modes A,B,C,D offer different hierarchy of control between the pitch, the velocity, a filter modulation and a LFO. An expression pedal can be connected to control the volume (modes A and B) or the LFO speed (modes C and D).

4. DESIGNING THE PERSEPHONE II

Three years after the first release of the Persephone, comments from users and suggestions for new features illustrate how important is the influence of new controllers developed by the game and communication industries (e.g. multi-touch surfaces and Nintendo Wii games) on the perception of new musical interfaces. A growing demand called for a polyphonic ribbon and stronger integration into the computer music environment by adding a USB I/O to the MIDI and CV I/O.

Connections

Connections are located on the rear side of the control panel and protected from dust and other sources of deterioration by the Persephone suitcase top when closed. For the desktop version, we recommend to cover the unit with a cloth when not used to avoid dust. To remove dust from the unit, make sure the unit is turned off and clean it with a damp cloth only.

AC-12V: The Persephone MarkII use an external AC - 12 V - 1A power supply. Never open the unit when it is switched on.
on/off: There is no on/off switch. When on, the LED on the front panel is on.
USB: With the USB plug, you will be able to update the Persephone MarkII firmware.
MIDI out: Connect to your MIDI devices to use the Persephone as a MIDI controller. (See MIDI implementation).
MIDI in: to control the Persephone
Audio out: main audio out. Plug it to your amplifier audio in.
Beware! Plugging the audio out into the Pedal in will shut the Persephone down and may be a cause of severe damages to the unit.
Pedal 1: You may plug an expression pedal into the Pedal in jack 6,35 input. With this pedal, you will be able to control the volume, but also the LFO frequency.
Pedal 2: You may plug an expression pedal into the Pedal in jack 6,35 input. With this pedal, you will be able to control the volume, but also the LFO frequency.
CV ½: Connect the CV out to the CV in of another analogue synthesizer to control it with the Persephone. For a CV connection, the pitch1 is on the tip and pitch2 on the ring. < pitch 1/pitch2
CV ¾: Affected to filter and VCA (sources can be modified with custom routings)

Plugging your Persephone for the first time

Powering the Persephone
Make sure you are using the right AC 12V 1A power supply. Be aware that using a DC power supply may cause irreversible damages to the unit. The red light on the front of the Persephone should light when right plugged.

Plugging your Persephone on guitar amps
You may use all types of guitar amplifier. Connect the audio out of the Persephone to the audio in of your amp. The Persephone sound generator is 100% analogue, therefore, it can reach very high frequencies. Always turn down the volume of your amplifier when you first play the Persephone to avoid any damage to your loud speakers. If you add a little reverberation to the sound it will sound great.

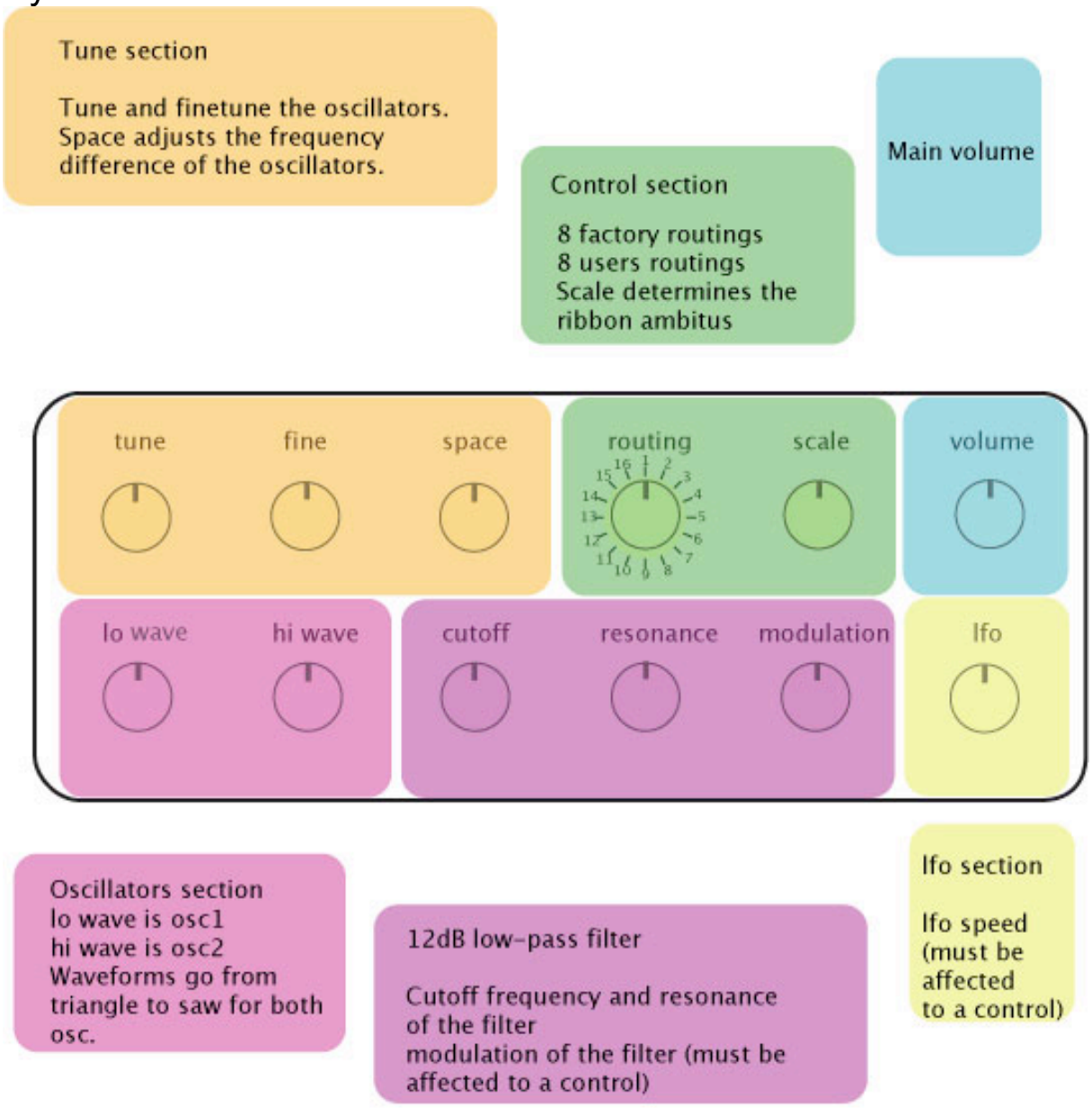
Plugging your Persephone in MIDI
Note that the MIDI is disactivated per default.
You can activate it via the software editor.

Plugging your Persephone to your computer
Connect your Persephone to your computer via USB. A Persephone icon will appear in the MIDI devices. Note that you don't have to activate MIDI to use USB.

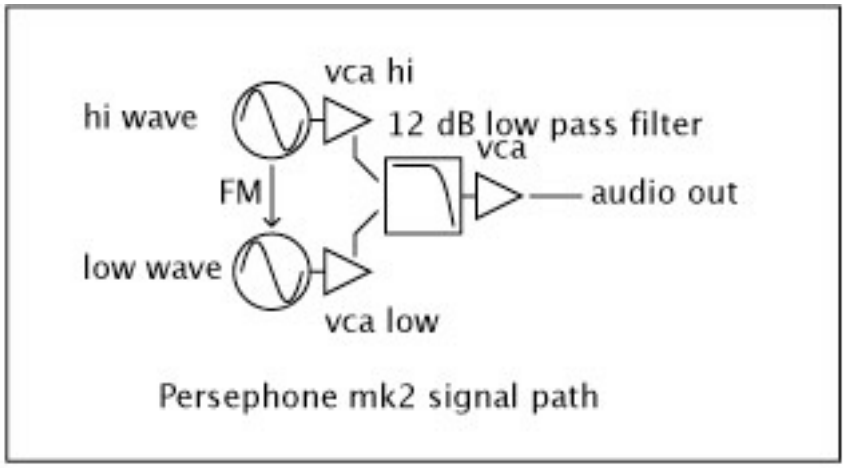
Does your computer recognize the new USB interface?
On Windows (here the French version on XP), your Persephone should appear as an audio device in the audio /video & game device window.
On OSX it's even easier, the Persephone should appear in the audio & midi configuration panel.

Configure your software & start playing
Once the Persephone has been recognized as an audio device by your computer, open your MIDI software.
Select the input midi port (audio device for XP/VISTA, Persephone for OSX)
By default :
input 1 sends CC1 on channel 1(CC for continuous controller)
input 2 sends CC2 on channel 1
input 3 sends CC3 on channel 1
input 4 sends CC4 on channel 1
input 5 sends CC5 on channel 1
input 6 sends CC6 on channel 1
input 7 sends CC7 on channel 1
input 8 sends CC8 on channel 1
Configure your software to match these parameters.

Synthesis section



Synthesis architecture



1. Bus affectation

ribbon 1	low pitch
ribbon 2	hi pitch
pression	vca low
key	vca hi
pedal 1	filter mod
pedal 2	filter
LFO out	FM vco 2 > vco 1
Constant 0	main VCA
Constant 1	

2. modulation bus source modulation destination

Oscillators section

Lo wave - Hi wave – space

The sound of the Persephone is generated by two 100% analogue oscillators. Like all analogue oscillators, its sound can differ depending on temperature conditions.
Hi Wave: waveform from triangle to sawtooth.
Lo wave: waveform from triangle to sawtooth.
Scale: adjusts the frequency difference between the two oscillators lo wave and hi wave.
Volume: adjusts the main volume

Listen to the lo wave waveform.
Set the routing 1, so you get only one oscillator. Set the scale. Try a glissado with the triangle waveform. Turn the lo wave knob to the right to get a sawtooth waveform. Listen to the difference.

Listen to the hi wave waveform.
Hi wave alone being the same than the lo wave, listen to the low wave.

Using the space knob enables to increase or decrease the frequency difference between osc1 and osc2.
In routing 1 to 4 with 1 position, press the ribbon and adjust th espace knob to hear the difference between the 2 osc.
In other modes, space adjusts the osc2.

How do I adjust the volume of osc1 and osc2 ?
The waveforms triangle has less harmonics. Using this waveform on one oscillator will turn down its volume.

Tune section

Tune tunes the oscillators.
Fine adjusts the finetune of the oscillators.
Scale sets the ambitus of the ribbon from 1, 2, 5 or 10 octaves.

How to scale the ribbon?
You can adjust the scale of the ribbon from 1, 2, 5 or 10 octaves.
If you wish to use another ambitus, it's possible to set the scale with a trimmer inside the instrument.

Is it possible to have different scale for each oscillator?
No, it's not possible.

I don't hear anything.
Remember that the frequency range of the oscillators goes far beyond the frequency human ear can hear. With a scale of 1 octave with the tune at its minimum value or its maximum value, the Persephone will make no auditable sounds. When you don't hear any sound, first check the routing selection (ribbon on pitch), set an ambitus of 5 octaves and turn the know tune while pressing the ribbon. In this medium setting, you will go back to auditable frequencies.

Filter section

Cutoff - resonance - modulation

Low-pass filter: The Persephone has an analogue resonant 12dB low-pass filter, which modulates the sound source. You can set the filter frequency with the knobs cutoff and resonance and its modulation amount with the knob modulation.
Cutoff: The knob cutoff sets the frequency at which the filter opens and closes.
Resonance : With the knob resonance, you may adjust the resonance of the filter.
The filter affects both oscillators.

Note that in the sources, there are two parameters for the filter: filter and filter modulation (see routing table).

Listen to the filter
In routing presets 1 & 2, the filter is affected to the ribbon position with the low wave pitch. The filter closes in the low tones and opens in the higher tones. In preset 1, the filter modulation is affected to the pressure of the ribbon. Press the ribbon with different strength to hear the filter. In preset 2, the filter modulation is affected to the key. Press the key while playing the ribbon to hear the filter.

Modulating the volume of one oscillator with the filter
The filter can be used to modulate the volume of one oscillator. With one oscillator set on a triangle wave and the other one on a saw waveform, the volume of oscillator with the triangle waveform willl sound lower.

Play with the filter with the expression key
In routing presets 2, 4, 5, the filter modulation is affected to the key. Slightly press the key to hear the filter.

LFO section

Modulation – lfo

The LFO has a triangle waveform.
Modulation: The knob 'modulation' sets the modulation amount of the LFO on the selected source.

Listen « LFO mod to filter »
With routings 1, 2, 3, 4, 5, 6, the LFO (source) modulates the filter via an expression pedal connected to the Pedal 1 of the Persephone. Connect an expression pedal to the Pedal 1 of the Persephone and try the LFO mod to filter.

Listen « LFO mod to VCA »
With routing 7, the LFO (source) modulates the VCA via an expression pedal connected to the Pedal 1 of the Persephone. Connect an expression pedal to the Pedal 1 of the Persephone and try the LFO mod to VCA.

Listen to LFO mod to hi wave freq
With routing 8, the LFO (source) modulates the hi wave frequency via an expression pedal connected to the Pedal 1 of the Persephone. Connect an expression pedal to the Pedal 1 of the Persephone and try the LFO mod to hi wave freq.

Control Section and routings

The Persephone controllers are 100% digital. The Persephone has different control tools: the ribbon which allows pressure and 2 positions control, the expression key and 2 pedals.

All I should know about the ribbon

CAUTION! The ribbon is very fragile. Avoid sharp object contact with the ribbon. Do not try to remove the ribbon from the panel. To clean the ribbon, use a dry cloth.

The ribbon responds to changes in voltage or resistance caused by changing the finger position along its surface. The Persephone ribbon controller is also able to record pressure or velocity. The ribbon is a linear potentiometer that generates different control voltages depending on where it is touched. These changes in voltage are applied to the voltage-controlled oscillator and the filter. The voltage fluctuations are also translated into binary data and used to control digital modulation. The ribbon is linear. The position of your finger will determine the pitch of the note played.

Changing the ribbon's scale
Scale: allows scaling the Persephone's ribbon from 1, 2, 5 to 10 octaves.
The Persephone can generate sounds beyond the frequencies human beings can hear. Your pets may be very sensitive to some high frequencies… Note that this is possible to set the scale on another ambitus.

How to mark the ribbon?
The ribbon has no marks, but it's possible to tape a paper with your own marks on the wood.

First steps with the duophonic ribbon
The Persephone MarkII is the first duophonic ribbon synthesizer on the market. Duophonic means that the same ribbon can produce two sounds when two positions (highest and lowest) are pressed on the ribbon. Making the ribbon duophonic extends the instrument sonorities spectral to play simple chords. With ribbons, the resistance is usually measured where at the stimulated position (the ribbon is pressed). Here, the resistance is measured at each extremity of the ribbon. The duophonic ribbon allows modulation capabilities like frequency modulation of one oscillator by the other one. Each oscillator has a dedicated 12dB low-pass filter to adjust the low and hi sounds separately.
The ribbon is divided is 3 different sources : position ribbon 1, position ribbon2 and ribbon pressure. The position on the ribbon always determines the pitch.

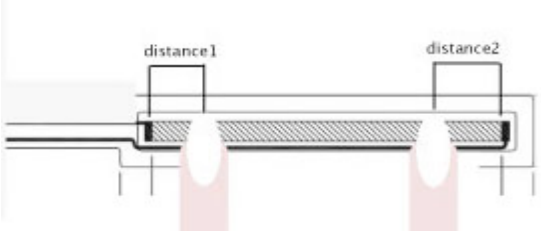


fig.1. Duophonic ribbon

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Listen to the two oscillators
Play the lo wave only. With routing 2, the ribbon controls the pitch of the osc 1. The volume is controlled by the pressure onto the ribbon. Play a glissando on the ribbon. Adjust the waveform of the osc1 from triangle to saw.

Now, select routing 5. With this routing, hi wave controls the pitch of osc 1; lowave controls the pitch of osc2. Play with the knobs tune & scale to hear the different frequencies of the oscillators.

Play the 2 oscillators together on ribbon position 1
With routings 3 and 4, both oscillators are affected to the ribbon position 1. Play with the knobs tune & scale to hear the different frequencies of the oscillators.

Can I play osc 1 and a sample on the other finger?
Connect the Persephone to your computer. Affect the sample to pitch 2.

How to use the pressure sensitivity
The pressure of your finger will control the velocity or the amplitude of the note played.

All I should know about the Expression key

The expression key is controlled with an optical sensor able to reproduce the slightest movement of the key. This is a great control tool for tremolo effects.

Play the expression key
With routing 1, the key controls the volume. This means that when you press the ribbon (without pressing the key), no sound is played. When you slowly press the key, the volume of the note will increase. Les Ondes Martenot had such an expression key.

Expression key destinations
With the preset routings, the expression key is affected to the filter modulation or to the volume. Only routing 8 differs with the expression key being affected to the FM.

All I should know about the Expression pedal 1

An expression pedal can be connected to the Pedal 1 at the rear side of the Persephone to control the LFO modulation on the LFO destination (filter, VCA or hi wave freq).

All I should know about the Expression pedal 2

A second expression pedal can be connected to the Pedal 2 at the rear side of the Persephone to control the FM.

What is FM?

FM is frequency modulation. The carrier oscillator is modulated in frequency by a modulator oscillator. The output of the modulating oscillator is added to the fundamental carrier frequancy, causing it to vary up and down. The amplitude of the modulator determines the amount of modulation or the frequency deviation from the fundamental frequency.

Routings

16 routings enable to select different routing architectures. 8 routings are fixed (factory routings) and 8 are users routings configurable thru a software. Users routings will be stored in an internal memory.

Persephone markII

routing presets

Users routings

The Persephone mkII editor is available on www.eowave.com/members
You may need to install Cycling74 Max5 runtime before lauching the editor. You can download it on www.cycling74.com with the Max5 free trial. The runtime will remain on your computer when the 30 days trial are over. With the editor, you will be able to simply modify the source and destination of the controls.

Source and destinations

Note
You can't use 2 sources on 1 destination.
It's possible to use 1 source for 2 destinations.

MIDI Implementation

MIDI option is set by default. Receive channel 1- 16
Pressing the expression key while powering up the unit will disactivate MIDI.

Sending Control Change Message
Key CC-7
Pressure CC-1
Pedal CC-2
Pitch – Pitch bend
Note to be sent
Note on 60/vel 127 while pressing the ribbon,
Note of 60/vel 0 while releasing the finger from the ribbon

Sending MIDI PROGRAM CHANGE
Message will affect different parameters of the Persephone

Changing the MIDI channel
MIDI CHANNEL PC 1 –16 (on current midi channel)
The midi channel is stored in an non volatile flash ram

Use the Persephone as a MIDI controller
To use the Persephone as a MIDI controller or to be able to record and playback the sound on a sequencer, it should be set to local OFF mode after each powering up.
MIDI LOCAL ON PC 20 (on current midi channel) (default value)
MIDI LOCAL OFF PC 21 (on current midi channel)

MIDI KB half tone mode
The half tone mode enables to trigger only half tone notes from the ribbon and send them via MIDI. The mode 1 calculates the nearest 1/2 tone from the first pitch played and sends the pitchbend of that note. It will also affect the internal oscillator by playing only half tone notes at each first contact onto the ribbon. The mode 2 only sends notes.
MIDI KB 1/2 TONE mode OFF PC 22 (default value)
MIDI KB 1/2 ON mode 1 PC 23
MIDI KB 1/2 ON mode 2 PC 24

Terms of Warrant

The Persephone has a one year term warrant after the date of purchase. Shipping the unit back to Eowave will be at the charge of the owner. Any damage resulting from misuse of the instrument is not covered by the warrant.

Eowave Team

The Persephone has been designed and developed by Marc Sirguy, MESI/eowave CEO.
Design, manual, marketing and export: Emmanuelle Gallin.
Thank you to all who have shown their interest since the very beginning of this project.

Contact & Support

Eowave
6, rue Marceau - 94200 Ivry-sur-Seine – France
Tel: +33/1 45 15 41 95 - Fax : +33/1 45 15 07 24

CE & FCC Information

1. Important notice: do not modify this unit. This product, when installed as indicated n the instructions contained in this manual, is compatible with the CE norm & FCC requirements.
2. Important! When connecting this product to accessories or/and to another product, use only high quality shielded cables. Cables supplied with this product must be used. Follow all installation instructions. Failure to follow instruction could void your FCC authorization to use this product in the USA.
3. Note: this product has been tested and found to comply with the requirements listed in the FCC Regulations, Part 15 for Class B digital devices & in The European Standart EN 50081-1 on Electromagnetic Compatibility – Generic emission standart on residential, commercial and light industry. Compliance with these requirements provides a reasonable level of assurance that the use of this product in a residential environment will not result in harmful interference with other electronic devices.